

WHAT IS CLAIMED IS:

1. A method for the determination of polymer molecular weight, comprising:
- 5 injecting a known volume of an analytical sample comprising a polymer into a flow analysis system comprising a chromatographic column, a concentration detector, and a molar mass detector;
- effecting a minimally dispersive separation of the analytical sample with the chromatographic column to yield a high molecular weight fraction;
- 10 determining the polymer concentration in the high molecular weight fraction using the concentration detector;
- determining the molar mass in the high molecular weight fraction using the molar mass detector; and
- 15 deriving an average molecular weight from the polymer concentration and the molar mass;
- wherein the total analysis time is not greater than about 5 minutes per sample.
2. The method of claim 1, wherein the polymer comprises a polyester.
3. The method of claim 2, wherein the polyester is synthesized from at least one dicarboxylic acid selected from the group consisting of terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, cyclohexane-1,4-dicarboxylic acid, cyclohexane-1,3-dicarboxylic acid, oxalic acid, maleic acid, succinic acid, glutaric acid, adipic acid, and pivalic acid; and at least one diol selected from the group consisting of ethylene glycol, propylene glycols, butylene glycols, cyclohexanedimethanol, cyclobutanedimethanol, 2,2-bis-(4-hydroxyphenyl)propane, hydroquinone, resorcinol, 2,2-bis-(4-hydroxyphenyl)pentane, 2,4'-dihydroxydiphenylmethane, bis-(2-hydroxyphenyl)methane, bis-(4-hydroxyphenyl)methane, bis-(4-hydroxy-5-nitrophenyl)methane, 1,1-bis-(4-hydroxyphenyl)ethane, 3,3-bis-(4-hydroxyphenyl)pentane, 2,2'-dihydroxydiphenyl, 2,6-dihydroxynaphthylene, bis-(4-hydroxyphenyl)sulfone, 2,2'-

dihydroxydiphenylsulfone, 4,4'-dihydroxydiphenylether, 4,4'-dihydroxy-2,5-diethoxydiphenylether, and 1,1-bis(3-methyl-4-hydroxyphenyl)cyclohexane.

4. The method of claim 1, wherein the polymer comprises an aromatic polycarbonate.

5. The method of claim 4, wherein the aromatic polycarbonate is synthesized from at least one dihydric phenol selected from the group consisting of 2,2-bis-(4-hydroxyphenyl)propane; hydroquinone; resorcinol; 2,2-bis-(4-hydroxyphenyl)pentane; 2,4'-dihydroxydiphenylmethane; bis-(2-hydroxyphenyl)methane; bis-(4-hydroxyphenyl)methane; bis-(4-hydroxy-5-nitrophenyl)methane; 1,1-bis-(4-hydroxyphenyl)ethane; 3,3-bis-(4-hydroxyphenyl)pentane; 2,2'-dihydroxydiphenyl; 2,6-dihydroxynaphthylene; bis-(4-hydroxyphenyl)sulfone; 2,2'-dihydroxydiphenylsulfone; 4,4'-dihydroxydiphenylether; 4,4'-dihydroxy-2,5-diethoxydiphenylether; and 1,1-bis(3-methyl-4-hydroxyphenyl)cyclohexane.

6. The method of claim 4, wherein the analytical sample comprising aromatic polycarbonate is prepared by dissolving an aromatic polycarbonate resin in a suitable solvent.

7. The method of claim 6, wherein the suitable solvent is selected from the group consisting of benzene, toluene, xylene, chloroform, tetrahydrofuran, methylene chloride, trichloroethylene, dichloroethane, chlorobenzene, dichlorobenzene, trichlorobenzene, methyl acetate, ethyl acetate, hexafluoroisopropanol, and mixtures comprising at least one of the foregoing solvents.

8. The method of claim 6, wherein the suitable solvent is selected from the group consisting of benzene, toluene, xylene, chloroform, tetrahydrofuran, dichloromethane, and mixtures comprising at least one of the foregoing.

9. The method of claim 1, wherein the analytical sample comprises a polymerization reaction mixture.

10. The method of claim 9, wherein the minimally dispersive separation yields a high molecular weight fraction substantially free of monomers and polymerization catalysts.

11. The method of claim 1, wherein the chromatographic column comprises at least one size exclusion chromatographic column.

12. The method of claim 1, wherein the minimally dispersive separation yields a high molecular weight fraction having a baseline peak width less than about 30 seconds at at least one of the molar mass detector or the concentration detector.

13. The method of claim 1, wherein the minimally dispersive separation yields a high molecular weight fraction having a baseline peak width less than about 20 seconds at at least one of the molar mass detector or the concentration detector.

14. The method of claim 1, wherein the minimally dispersive separation yields a high molecular weight fraction having a baseline peak width less than about 10 seconds at at least one of the molar mass detector or the concentration detector.

15. The method of claim 1, wherein the minimally dispersive separation yields a high molecular weight fraction having a peak width at half height less than about 10 seconds at at least one of the molar mass detector or the concentration detector.

16. The method of claim 1, wherein the minimally dispersive separation yields a high molecular weight fraction having a peak width at half height less than about 5 seconds at at least one of the molar mass detector or the concentration detector.

17. The method of claim 1, wherein the minimally dispersive separation yields a high molecular weight fraction having a peak width at half height less than about 3 seconds at at least one of the molar mass detector or the concentration detector.

18. The method of claim 1, wherein the concentration detector utilizes one or more detection methods selected from the group consisting of infrared absorption spectroscopy, ultraviolet absorption spectroscopy, differential refractive index detection, fluorescence detection, ultrasonic detection, and evaporative light scattering detection.

19. The method of claim 1, wherein the molar mass detector utilizes one or more detection methods selected from the group consisting of light scattering, low angle light scattering, multiangle light scattering, and viscometry.

20. The method of claim 1, wherein the molar mass detector utilizes multiangle light scattering.

21. The method of claim 1, wherein determining the polymer concentration and determining the molar mass are conducted sequentially.

22. The method of claim 1, wherein determining the molar mass is conducted off-line.

23. The method of claim 1, wherein the total analysis time is not greater than about 3 minutes per sample.

24. The method of claim 1, wherein the total analysis time is not greater than about 1 minute per sample.

25. The method of claim 1, wherein the total analysis time is not greater than about 40 seconds per sample.

26. The method of claim 1, wherein the average molecular weight is a weight average molecular weight.

27. The method of claim 1, wherein the average molecular weight is a number average molecular weight.

28. A method for the determination of polymer molecular weight, comprising

providing a sample array comprising a plurality of spatially differentiated sites, each site comprising a polymer resin;

preparing an analytical sample for each spatially differentiated site by dissolving the polymer resin in a suitable solvent;

injecting a known amount of each analytical sample into a flow analysis system comprising a chromatographic column, a concentration detector, and a molar mass detector;

effecting a minimally dispersive separation of each analytical sample with the chromatographic column to yield a high molecular weight fraction substantially free of monomers;

determining the polymer concentration in the high molecular weight fraction of each analytical sample using the concentration detector;

determining the molar mass in the high molecular weight fraction of each analytical sample using the molar mass detector; and

deriving an average molecular weight for each analytical sample based on the polymer concentration and the molar mass;

wherein the total analysis time is not greater than about 5 minutes per sample.

29. The method of claim 28, wherein preparing an analytical sample for each spatially differentiated site, injecting a known amount of each analytical sample, effecting a minimally dispersive separation of each analytical sample, determining the polymer concentration in the high molecular weight fraction of each analytical sample, determining the molar mass in the high molecular weight fraction of each analytical sample, and deriving an average molecular weight for each analytical sample are conducted without human intervention.

30. A method for the determination of polycarbonate molecular weight, comprising:

injecting a known amount of an analytical sample comprising a polycarbonate resin into a flow analysis system comprising a chromatographic column, a concentration detector, and a molar mass detector;

effecting a minimally dispersive separation of the analytical sample with the chromatographic column to yield a high molecular weight fraction substantially free of monomers and catalysts, wherein the high molecular weight fraction has a peak width at half height less than about 5 seconds at least one of the molar mass detector or the concentration detector;

determining the polycarbonate concentration in the high molecular weight fraction using a differential refractive index detector;

determining the molar mass in the high molecular weight fraction using a light scattering detector; and

deriving an average molecular weight for the polycarbonate resin from the polycarbonate concentration and the molar mass;

wherein the total analysis time is not greater than about 40 seconds per sample.

31. A system for the determination of polymer average molecular weight, comprising:

a solvent delivery system;

an autoinjector for injecting a known volume of an analytical sample comprising a polymer;

a chromatographic column for effecting a minimally dispersive separation of the analytical sample to yield a high molecular weight fraction substantially free of monomers;

an in-line concentration detector for determining the polymer concentration in the high molecular weight fraction; and

a molar mass detector for determining the molar mass in the high molecular weight fraction;

wherein the system's total analysis time is not greater than about 5 minutes per sample.

32. The method of claim 31, wherein the molar mass detector is in-line.

33. The method of claim 31, wherein the molar mass detector is off-line.

34. The system of claim 31, further comprising a plurality of analytical samples comprising aromatic polycarbonate.

35. The system of claim 31, further comprising a sample preparation module for automatically preparing an analytical sample by dissolving an aromatic polycarbonate resin in a suitable solvent.

36. The system of claim 31, further comprising a computer for deriving an average molecular weight from the polymer concentration and the molar mass, and, optionally, for responsively controlling one or more of the solvent delivery system, the autoinjector, the concentration detector, and the molar mass detector.

37. An analysis system, comprising:

a solvent delivery system;

an autoinjector for injecting a known volume of each of a plurality of analytical samples comprising a polymer;

a chromatographic column for effecting a minimally dispersive separation of each analytical sample to yield a high molecular weight fraction substantially free of monomers;

an in-line concentration detector for determining the polymer concentration in the high molecular weight fraction of each sample;

a molar mass detector for determining the molar mass in the high molecular weight fraction of each sample; and

a computer;

wherein the system's total analysis time is not greater than 5 minutes per sample; and wherein computer control of the solvent delivery system, the autoinjector, the concentration detector, and the molar mass detector enables analysis of the plurality of analytical samples without human intervention.